TOTAL MAXIMUM DAILY LOAD FOR TOXAPHENE FOR THE SANTA CLARA RIVER ESTUARY

STAFF REPORT

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD - LOS ANGELES REGION

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LIST OF ACRONYMS

BCF – bioconcentration factor
BMP – best management practice
Caltrans – California Department of Transportation
CERES – California Environmental Resources Evaluation System
CFR – Code of Federal Regulations
CCC – Criteria Continuous Concentration
CMC – Criteria Maximum Concentration
COMM – commercial and sport fishing
CTR – California Toxics Rule
CWA – Clean Water Act
DPR – Department of Pesticide Regulation
ERL – Effects Range-Low
ERM – Effects Range-Median
EST – estuarine habitat
FCG – Fish Contaminant Goal
HCH – hexachlorocyclohexane
LA – load allocation
LARWQCB – California Regional Water Quality Control Board, Los Angeles Region
MAR – marine habitat
MGD – million gallons per day
MIGR – migration
MRP – monitoring and reporting plan
MS4 – municipal separate storm sewer system
NAS – National Academy of Sciences
NAV– navigation
NMFS – National Marine Fisheries Service
NOA – Notice of Applicability
NOAA – National Oceanic Atmospheric Administration
NPDES – National Pollutant Discharge Elimination System
OEHHA – Office of Environmental Health Hazard Assessment
PEL – Probable Effects Level
ppt – part per thousand
RARE – rare, threatened, or endangered species
RB – Regional Board
REC1 – water contact recreation
REC2 – non-contact water recreation
SCR – Santa Clara River
SMW – State Mussel Watch
SOP – standard operating procedure
SPWN – spawning, reproduction, and/or early development
SQG – sediment quality guidelines
SWAMP – Surface Water Ambient Monitoring Program
SWRCB – California State Water Resources Control Board
TEL – Threshold Effects Level

TMDL – Total Maximum Daily Load
TSM – Toxic Substance Monitoring
TTRL – Threshold Tissue Residue Levels
USEPA – United States Environmental Protection Agency
UWCD – United Water Conservation District
VCAILG – Ventura County Agriculture Irrigated Lands Group
VCWPD – Ventura County Watershed Protection District
VOC – volatile organic compound
VWRF – Ventura Water Reclamation Facility
WDR – Waste Discharge Requirements
WILD – wildlife habitat
WQA – water quality assessments
WQMP – Water Quality Management Plan
WQO – water quality objective

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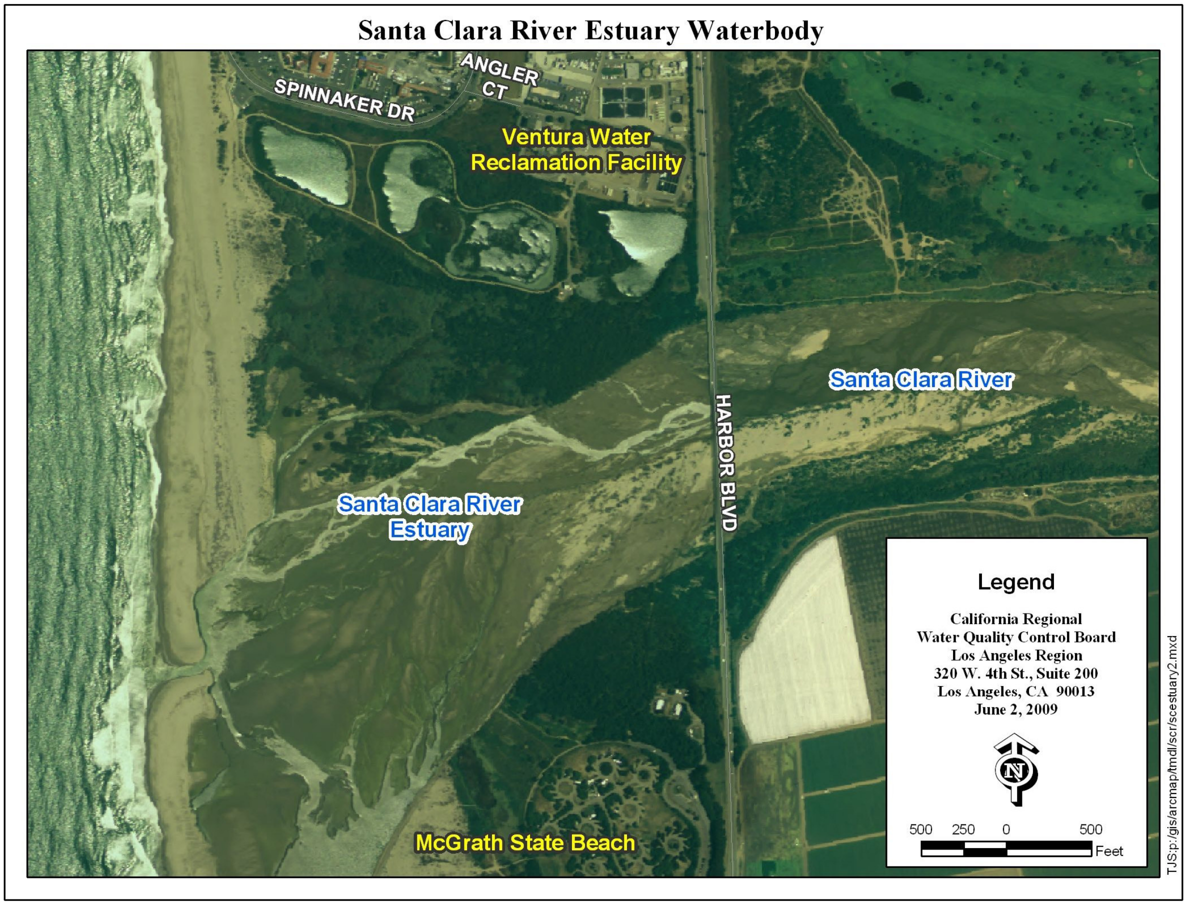
1 INTRODUCTION

The Santa Clara River (SCR) Estuary is identified on the 1998, 2002 and 2006 Clean Water Act (CWA) 303(d) lists of impaired water bodies as impaired due to Chem A and toxaphene. Chem A (abbreviation for chemical group A) is a suite of bio-accumulating pesticides that includes aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor epoxide, hexachlorocyclohexane (HCH) (including lindane), endosulfan, and toxaphene. Approved 303(d) listings require the development of a total maximum daily load (TMDL) to establish the amount of pollutants that a waterbody can receive without exceeding water quality standards.

The 1998 303(d) listing (and subsequent listings) for Chem A were predominately based on fish tissue concentrations of toxaphene. Toxaphene has been recently detected in tissue at levels that exceed standards. Chlordane has recently been detected in tissue at levels below standards. Therefore, this TMDL will only address the Chem A pollutant (toxaphene) that is causing the current impairment, and will require monitoring for chlordane to ensure no future impairments.

This document summarizes the information used by the California Regional Water Quality Control Board, Los Angeles Region (Regional Board or LARWQCB) to develop TMDLs for toxaphene in fish tissue in the SCR Estuary. The TMDL is being adopted as a single regulatory action through the renewal of the Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands (Conditional Waiver). The waterbody addressed in this TMDL is shown in Figure 1-1.

Figure 1-1. Santa Clara River Estuary.



1.1 REGULATORY BACKGROUND

Section 303(d) of the CWA requires that each State "shall identify those waters within its boundaries for which the effluent limitations are not stringent enough to implement any water quality objective applicable to such waters." The CWA also requires states to establish a priority ranking for waters on the 303(d) list of impaired waters and establish TMDLs for such waters.

The elements of a TMDL are described in 40 CFR 130.2 and 130.7 and Section 303(d) of the CWA, as well as in USEPA guidance (USEPA, 2000a). A TMDL is defined as the "sum of the individual waste load allocations for point sources and load allocations for nonpoint sources and natural background" (40 CFR 130.2) such that the capacity of the waterbody to assimilate pollutant loads (the loading capacity) is not exceeded. A TMDL is also required to account for seasonal variations and include a margin of safety to address uncertainty in the analysis (40 CFR 130.7).

States must develop water quality management plans to implement the TMDL (40 CFR 130.6). The USEPA has oversight authority for the 303(d) program and is required to review and either approve or disapprove the TMDLs submitted by states. In California, the State Water Resources

Control Board (State Board) and the nine Regional Water Quality Control Boards are responsible for preparing lists of impaired waterbodies under the 303(d) program and for preparing TMDLs, both subject to USEPA approval. If USEPA disapproves a TMDL submitted by a state, USEPA is required to establish a TMDL for that waterbody. The Regional Boards also hold regulatory authority for many of the instruments used to implement the TMDLs, such as the National Pollutant Discharge Elimination System (NPDES) permits, the state-specified Waste Discharge Requirements (WDRs), the State Water Resources Control Board's Nonpoint Source Implementation and Enforcement Policy, and the Conditional Waiver.

As part of its 1996 and 1998 regional water quality assessments (WQAs), the Regional Board identified over 700 waterbody-pollutant combinations in the Los Angeles Region where TMDLs would be required (LARWQCB, 1996, 1998). These are referred to as "listed" or "303(d) listed" waterbodies or waterbody segments. A 13-year schedule for development of TMDLs in the Los Angeles Region was established in a consent decree approved on March 22, 1999 (Heal the Bay Inc., et al. v. Browner, et al. C 98-4825 SBA). For the purpose of scheduling TMDL development, the consent decree combined the more than 700 waterbody-pollutant combinations into 92 TMDL analytical units. Analytical Unit 33 addresses the impairments in SCR Estuary associated with Chem A and toxaphene.

1.2 ENVIRONMENTAL SETTING

The SCR Estuary is located in Ventura County, between the cities of Ventura and Oxnard, along McGrath State Beach in the Santa Clara River Estuary Natural Reserve. The Estuary area extends from the ocean to just east of the Harbor Boulevard bridge, which crosses the Santa Clara River one-half mile from the mouth. The Ventura Water Reclamation Facility (VWRF) is on the north side of the estuary. The Ventura Harbor is north of the VWRF. A golf course lies to the east of Harbor Boulevard bridge. To the south are agricultural fields and a state park campground. The Estuary is a designated Natural Preserve within McGrath State Beach. It is designated for conservation and resource protection in the City of Oxnard 2020 General Plan (CERES, 2009).

The Estuary is closed by a berm, which forms at the mouth during periods of low flow. The berm is usually breached by storm water flows and/or wave overwashing, and closes again after varying lengths of time. In the marsh area outside the river channel the soils are coarse sand, sand, clay, sandy-clay and loam. In the riverbed, sediment sizes range from silt to gravel (CERES, 2009).

Since 1855, the Estuary has been modified by human activities. Agriculture, roads, urban development and levees have altered the Estuary. By the late 1920s roads and agricultural fields had become established. The VWRF, agricultural fields, Harbor Boulevard bridge, and a marina, all of which occupy the former delta, were in place by the late 1950s (CERES, 2009).

Flow upstream of the Estuary is seasonal except for controlled releases and wastewater treatment discharges. The channel is braided, and the banks are reinforced with groins and levees along much of the lower river. There are 3 active gravel operations in the upstream area and numerous water diversions, including the Freeman Diversion Dam, located approximately 10.7 miles from the ocean (CERES, 2009). The estuary receives approximately 8.5 million gallons per day

(MGD) of treated wastewater from the VWRF.

1.3 ORGANIZATION OF THIS DOCUMENT

Guidance from USEPA (1991) identifies seven elements of a TMDL. Sections 2 through 7 of this document present these elements, with the analysis and findings of this TMDL for that element. The required elements are as follows:

- **Section 2: Problem Identification.** This section presents the data used to add the waterbody to the 303(d) list, and summarizes existing conditions using that evidence along with any new information acquired since the listing. This element identifies the beneficial uses that are not supported; the water quality objectives (WQOs) designed to protect those beneficial uses; and summarizes the evidence supporting the decision to list, such as the number and severity of exceedances observed.
- **Section 3: Numeric Targets.** This section identifies the numeric targets established for the TMDLs and representing attainment of WQOs and beneficial uses. For this TMDL, the numeric targets are based on numeric WQOs for toxic pollutants in water and narrative WQOs for toxic pollutants in sediment and fish tissue.
- **Section 4: Source Assessment.** This section identifies the potential sources of toxaphene to SCR Estuary.
- **Section 5: Linkage Analysis, TMDL and Pollutant Allocations.** This section presents the analysis to evaluate the link between sources of toxaphene and the resulting conditions in the impaired waterbody. The pollutant loading capacity (i.e., assimilative capacity) and associated TMDL for toxaphene are identified. Each identifiable source is allocated quantitative load allocations for the listed pollutants, representing the load that it can discharge while still ensuring that the receiving water meets the WQOs. Allocations are designed to protect the waterbody from conditions that exceed the applicable numeric target. The allocations are based on critical conditions to ensure protection of the waterbody under all conditions.
- **Section 6: Implementation.** This section describes the regulatory tools, plans and other mechanisms available to achieve the load allocations.
- **Section 7: Monitoring.** This section describes the monitoring to ensure that the WQOs are attained.

2 PROBLEM IDENTIFICATION

The 303(d) listings for the SCR Estuary are based on concentrations of Chem A and Toxaphene in fish tissue. This group of pesticides is often referred to as legacy pesticides, because even though they have been banned from use for many years, they continue to persist in the environment and cause water quality impairments. This section provides an overview of water quality standards and guidelines applicable to the SCR Estuary and reviews the water quality data used in the 1998, 2002 and 2006 303(d) listings, and additional data gathered in the preparation of this TMDL.

2.1 WATER QUALITY STANDARDS

California state water quality standards consist of the following elements: 1) beneficial uses; 2) narrative and/or numeric WQOs; and 3) an antidegradation policy. In California, beneficial uses are defined by the Regional Boards in the Water Quality Control Plans (Basin Plans). Numeric and narrative objectives are specified in each region's Basin Plan and in statewide water quality control plans. The objectives are set to be protective of the beneficial uses in each waterbody in the region and/or to protect against degradation.

2.1.1 Beneficial Uses

The Basin Plan for the Los Angeles Regional Board defines 11 existing (E) beneficial uses for the SCR Estuary (Table 2-1).

Table 2-1. Beneficial uses of the Santa Clara River Estuary (LARWQCB, 1994).

Santa Clara River Watershed	Hydro Unit #	NAV	REC1	REC2	COMM	EST	MAR	WILD	RARE	MIGR	SPWN	WET[a]
Santa Clara River Estuary	403.11	E	E	E	E	E	E	E	E[b]	E[c]	E[c]	E

Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.
E: Existing beneficial use
a: Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action may require a detailed analysis of the area.
b: One or more rare species utilize all oceans, bays, estuaries, and wetlands for foraging and/or nesting.
c: Aquatic organisms utilize all bays, estuaries, lagoons, and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas that are heavily influenced by freshwater inputs.

The estuarine habitat (EST), marine habitat (MAR) and wildlife habitat (WILD) beneficial uses are existing designated uses to protect aquatic and terrestrial life that use the estuarine, marine, and wildlife habitat. The rare, threatened, or endangered species (RARE) use designation is designed to protect rare, threatened or endangered species that may utilize the estuary and adjacent wetlands for foraging or nesting habitat. There are existing uses to protect aquatic organisms utilizing the estuary for migration (MIGR) and for spawning, reproduction, and/or early development (SPWN). There are also beneficial uses associated with human use of the estuary including navigation (NAV) and commercial and sport fishing (COMM). The recreational uses for water contact recreation (REC1) and non-contact water recreation (REC2) apply as existing uses for the estuary. Discharges of pesticide pollutants to these waterbodies may result in impairments of beneficial uses associated with aquatic life (EST, MAR, WILD, RARE, MIGR, SPWN, and WET), human use of these resources (NAV, COMM), and recreational uses (REC1 and REC2).

2.1.2 Water Quality Objectives

As stated in the Basin Plan, WQOs are intended to protect the public health and welfare and to maintain or enhance water quality in relation to the designated existing and potential beneficial uses of the water. The Basin Plan specifies both narrative and numeric water quality objectives. The following narrative water quality objectives are the most pertinent to this TMDL. These narrative WQOs may be applied to both the water column and the sediments.

> Chemical Constituents: *Surface waters shall not contain concentrations of chemical constituents in amounts that adversely affect any designated beneficial use.*
>
> Bioaccumulation: *Toxic pollutants shall not be present at levels that will bioaccumulate in aquatic life to levels, which are harmful to aquatic life or human health.*
>
> Pesticides: *No individual pesticide or combination of pesticides shall be present in concentrations that adversely affect beneficial uses. There shall be no increase in pesticide concentrations found in bottom sediments or aquatic life*.
>
> Toxicity: *All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life.*

The Regional Board's narrative toxicity objective reflects and implements national policy set by Congress. The Clean Water Act states that, "it is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited." (33 U.S.C. 1251(a)(3).) In 2000, USEPA established numeric water quality objectives for pollutants addressed in this TMDL in the California Toxics Rule (CTR) (USEPA, 2000b). The CTR establishes numeric aquatic life criteria for 23 priority toxic pollutants and numeric human health criteria for 92 priority toxic pollutants. These criteria are established to protect human health and the environment and are applicable to inland surface waters, enclosed bays and estuaries.

For the protection of aquatic life, the CTR establishes short-term (acute) and long-term (chronic) criteria in both freshwater and saltwater. The acute criterion (CMC) equals the highest concentration of a pollutant to which aquatic life can be exposed for a short period of time without deleterious effects. The chronic criterion (CCC) equals the highest concentration of a pollutant to which aquatic life can be exposed for an extended period of time (4 days) without deleterious effects. Freshwater criteria apply to waters in which the salinity is equal to or less than 1 part per thousand (ppt) 95 percent or more of the time. Saltwater criteria apply to waters in which salinity is equal to or greater than 10 ppt 95 percent or more of the time. For waters in which the salinity is between 1 and 10 ppt, the more stringent of the two criteria apply.

The human health criteria are established to protect the general population from priority toxic pollutants regulated as carcinogens (cancer-causing substances) and are based on the consumption of water and aquatic organisms or aquatic organisms only, assuming a typical consumption of 6.5 grams per day of fish and shellfish and drinking 2.0 liters per day of water. Table 2-2 summarizes the CTR aquatic life criteria (freshwater and saltwater) and human health criteria for organic constituents covered under this TMDL.

Table 2-2. Water quality objectives established in the CTR for Chem A pesticides (including toxaphene).

Pollutant	**Criteria for the Protection of Aquatic Life**				**Criteria for the Protection of Human Health**	
	Freshwater		**Saltwater**			
	Acute (µg/L)	**Chronic (µg/L)**	**Acute (µg/L)**	**Chronic (µg/L)**	**Water & Organisms (µg/L)**	**Organisms only (µg/L)**
Aldrin	3		1.3		0.00013	0.00014
Dieldrin	0.24	0.056	0.71	0.0019	0.00014	0.00014
Endrin	0.086	0.036	0.037	0.0023	0.76	0.81
Heptachlor	0.52	0.0038	0.053	0.0036	0.00021	0.00021
Heptachlor Epoxide	0.52	0.0038	0.053	0.0036	0.00010	0.00011
Chlordane	2.4	0.0043	0.09	0.004	0.00057	0.00059
α-HCH					0.0039	0.013
β-HCH					0.014	0.046
γ-HCH (Lindane)	0.95		0.16		0.019	0.063
δ-HCH						
Endosulfan I	0.22	0.056	0.034	0.0087	110	240
Endosulfan II	0.22	0.056	0.034	0.0087	110	240
Endosulfan Sulfate					110	240
Toxaphene	0.73	0.0002	0.21	0.0002	0.00073	0.00075

2.1.3 Sediment Guidelines

There are no numeric water quality objectives for sediment in the Basin Plan. In the previous listing cycles, the Regional Board evaluated sediment contaminants relative to sediment quality guidelines (SQGs), specifically the values for Effects Range-Median (ERM) (Long et al., 1995), and Probable Effects Level (PEL) (MacDonald, 1994). These SQGs are based on empirical data compiled from numerous field and laboratory studies performed in North America.

The National Oceanic Atmospheric Administration (NOAA) (Long et al., 1995) assembled data from throughout the country that correlated chemical concentrations in sediments with effects. These data included spiked bioassay results and field data of matched biological effects and chemistry. The product of the analysis is the identification of two concentrations for each substance evaluated. The Effects Range-Low (ERL) values were set at the 10th percentile of the ranked data and represent the point below which adverse biological effects are not expected to occur. The ERM values were set at the 50th percentile and are interpreted as the point above which adverse effects are expected.

The Threshold Effects Level (TEL) and PEL values were developed by the State of Florida and were based on a biological effects empirical approach similar to the ERLs/ERMs. The development of the TELs and PELs differ from the development of the ERLs and ERMs in that data showing no effects were incorporated into the analysis. In the Florida weight-of-evidence approach, two databases were assembled: a "no-effects" database and an "effects" database. The TEL values were generated by taking the geometric mean of the 15th percentile value in the effects database and the 50th percentile value of the no-effects database. The PEL values were generated by taking the geometric mean of the 50th percentile value in the effects database and the 85th percentile value of the no-effects database. By including the no-effect data in the analysis, a clearer picture of the chemical concentrations associated with the three ranges of concern (no effects, possible effects, and probable effects) can be established.

The ERLs and TELs are presumed, with a high degree of confidence, to be non-toxic levels and pose no potential threat. The ERMs and PELs identify pollutant concentrations that are more probably elevated to toxic levels. The Regional Board used ERMs and PELs during the 2002 and 2006 water quality assessments (Table 2-3). The ERLs have been applied as sediment numeric targets in other Regional Board Pesticide TMDLs, such as the Calleguas Creek Organochlorine Pesticides and PCBs TMDL and the Ballona Creek Estuary Toxic Pollutants TMDL.

Table 2-3. Summary of freshwater and marine sediment quality guidelines.

Pollutant	Marine Estuarine Sediments			Freshwater Sediments	
	ERM	PEL	Other Sediment Quality Guideline	PEL	Probable Effect Concentration [2]
Aldrin					
Dieldrin	8	4.3		6.67	61.8
Endrin			760 [1]	62.4	207
Heptachlor					
Heptachlor Epoxide				2.74	
Chlordane	6	4.79		8.9	17.6
α-HCH					
β-HCH					
γ-HCH (Lindane)		0.99	370 [3]	1.38	4.99
δ-HCH					
Endosulfan (Total)					
Toxaphene					

Note:

[1] USEPA, 1993. [2] MacDonald et al., 2000. [3] Fairey et al., 2001. [4] Unit in ppb, dry weight.

2.1.4 Fish Tissue Guidelines

There are no numeric WQOs for fish tissue in the Basin Plan. The National Academy of Sciences (NAS) and National Academy of Engineering recommended maximum concentrations of toxic substances in freshwater fish tissue, which is useful in assessing the effects of pesticides on aquatic organisms and wildlife when EPA aquatic-life criteria are not available. They were established to protect both the organisms containing the toxic compounds and the species that consume these contaminated organisms. NAS guidelines are compared to data from whole fish samples only. The NAS recommended guidelines for freshwater, whole fish are 100 ppb, wet weight for all Chem A chemicals, individually or in combination. The original 1998 listings were based on a comparison to NAS guidelines.

Screening values have also been developed by the Office of Environmental Health Hazard Assessment (OEHHA). These screening values relate human health endpoints to contaminant concentrations in fish based on an average consumption rate for fish and shellfish. In June 2008, OEHHA published "Fish Contaminant Goals and Advisory Tissue Levels for Common Contaminants in California Sport Fish: Chlordane, DDTs, Dieldrin, Methylmercury, PCBs, Selenium, and Toxaphene". Available Fish Contaminant Goals (FCGs) for Chem A chemicals are 0.46 ppb for dieldrin, 5.6 ppb for Chlordane, and 6.1 ppb for toxaphene (all for wet weight).

2.1.5 Antidegradation

State Board Resolution 68-16, "Statement of Policy with Respect to Maintaining High Quality Water" in California, known as the "Antidegradation Policy," protects surface and ground waters from degradation. Any actions that can adversely affect water quality in all surface and ground waters must be consistent with the maximum benefit to the people of the state, must not unreasonably affect present and anticipated beneficial use of such water, and must not result in water quality less than that prescribed in water quality plans and policies. Furthermore, any actions that can adversely affect surface waters are also subject to the federal Antidegradation Policy (40 CFR 131.12).

2.2 WATER QUALITY DATA REVIEW

This section summarizes the data for the SCR Estuary for the listed toxic pollutants in water, fish and sediments. The summary includes data considered by the Regional Board and USEPA in developing the 1998, 2002, and 2006 303(d) lists as well as additional data. This section discusses available water column, sediment, and fish tissue data.

2.2.1 Water Column

The VWRF of the City of San Buenaventura conducts receiving water sampling for organochlorine pesticides in the SCR Estuary as part of their waste discharge requirements. A total of 57 receiving water samples were collected by the VWRF from 2002 to 2006. One surface water sample was collected by the State of California Surface Water Ambient Monitoring Program (SWAMP) in 2001. The data are summarized in Table 2-4. Of the 60 samples, Chem A pesticides were detected in two samples: Dieldrin was detected in one sample and the concentration was above the CTR human health criteria; Endosulfan sulfate was detected in one sample but the concentration was below the CTR human health criteria. It is noted that analytical detection limits were often greater than CTR criteria, so that no detection does not necessarily mean the water quality standards are met.

The 303(d) listing policy (SWRCB, 2004) requires a minimum of 6 samples to exceed a standard or guideline for any toxic pollutant to be added to the CWA 303(d) list for a sample size of 60-71. Based on the data available, there is no indication that CTR criteria are exceeded such that a listing is required for any of the Chem A pollutants in water in the Santa Clara River Estuary.

Table 2-4. Summary statistics for Chem A chemicals in all water samples.

Constituent	No. of Samples	No. Detect	Target (µg/L)	No. Exceeded
Aldrin	60	0	0.00014 [1]	0
Dieldrin	60	1	0.00014 [1]	1
Endrin	60	0	0.0023 [2]	0
Heptachlor	60	0	0.00021 [1]	0
Heptachlor Epoxide	60	0	0.00011 [1]	0
Chlordane (Total)	60	0	0.00059 [1]	0
α-HCH	60	0	0.013 [1]	0
β-HCH	60	0	0.046 [1]	0
γ-HCH (Lindane)	60	0	0.063 [1]	0
δ-HCH	60	0	NA	0
Endosulfan I	60	0	0.0087 [2]	0
Endosulfan II	60	0	0.0087 [2]	0
Endosulfan Sulfate	60	1	240 [1]	0
Toxaphene	59	0	0.0002 [2]	0

[1]: CTR human health criteria.

[2]: CTR water quality criteria for protection of aquatic life. Chronic criteria (Criteria Continuous Concentration, or CCC) are applied.

2.2.2 Sediment

To assess impacts to sediments, we reviewed data from the State Mussel Watch (SMW) Program and from SWAMP. The available data from 1991 to 2008 are summarized in Table 2-5. Most of the samples were non-detect. Dieldrin and total endosulfan were detected in one sample and total chlordane was detected in two of the three samples. The detected concentrations of dieldrin and total chlordane are lower than the ERM/PEL values. There is no sediment quality guideline available for endosulfan. Therefore, none of the samples exceeded ERM/PEL limits for Chem A chemicals; however, detection limits were often greater than ERM/PEL values.

To assess more recent sediment conditions, Regional Board (RB) staff collected additional sediment samples on December 12, 2007 and January 16, 2008. Samples were collected from 4 representative sites from the Santa Clara River Estuary. Samples were collected following the sediment collection standard operating procedure (SOP) in the SWAMP Quality Assurance

Management Plan. Samples were shipped to the EPA Region IX laboratory where they were analyzed for organochlorine pesticides. No analysis of sediment toxicity or assessment of benthic community was performed. The results are presented in Table 2-5. There is one detection of β-HCH, but there is no SQG available for β-HCH. No other Chem A chemicals were detected; however, detection limits were often greater than ERM/PEL values.

Table 2-5. Summary of available sediment quality data for the Estuary.

Data Source	Sample Date	aldrin	dieldrin	endrin	heptachlor	heptachlor epoxide	chlordane total	α-HCH	β-HCH	γ-HCH	δ-HCH	endosulfan total	taxaphene
SMW	8/29/1991	ND	0.6	ND	ND	ND	4.4	ND	ND	ND	ND	3.5	ND
SMW	8/29/1991	ND	ND	ND	ND	ND	2.1	ND	ND	ND	ND	ND	ND
SWAMP	11/14/2001	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
RB	12/12/2007	ND	ND	ND	ND	ND	ND	ND	2.9	ND	ND	ND	ND
RB	1/16/2008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
RB	1/16/2008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
RB	1/16/2008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Note:

(1) ND = Not Detected.

(2) Organic chemical data in parts per billion (ppb), dry weight.

2.2.3 Fish and Shellfish Tissue

Analysis of fish tissue for chemical contaminants provides a more direct means for assessing impacts. To assess potential impairments associated with contaminant concentrations in fish and shellfish tissue, we reviewed the data used for the 1998 303(d) list. Tissue data used in the assessment were based on two fish tissue samples from the Toxic Substance Monitoring (TSM) Program (Table 2-6). The two samples were sampled in 1994 and 1995. The concentrations of toxaphene in both samples are above the FCG of 6.1 ppb. In one of the tissue samples, dieldrin is detected above the FCG of 0.46 ppb.

During 1999 and 2000, two additional fish tissue samples were collected. Toxaphene was detected in both samples at levels at least 3 times lower than in the 1994 and 1995 samples, but still greater than the FCG of 6.1 ppb. Chlordane was detected, but at a level lower than the FCG of 5.6 ppb.

To assess more recent fish tissue concentrations, the Ventura County Agriculture Irrigated Lands Group (VCAILG) collected additional fish tissue samples from the SCR Estuary on April 8, 2008. The results are presented in Table 2-6. The concentration of toxaphene was above the FCG of 6.1 ppb. Chlordane was detected above the FCG of 5.6 ppb. No other contaminants in the Chem A grouping were detected.

Table 2-6. Summary of fish tissue data (ppb, wet weight). Station locations are in Santa Clara River Estuary.

Data Source	Sampling Date	Species	Number	Tissue	Aldrin	Dieldrin	Endrin	Heptachlor	Heptachlor Epoxide	Chlordane (Total)	HCH (Total)	Endosulfan (Total)	Toxaphene	ChemA
TSM	6/24/1994	Arroyo Chub	200	F	ND	ND	ND	ND	ND	ND	ND	ND	250.0	250.0
TSM	6/30/1995	Santa Ana Sucker	35	W	ND	5.5	ND	ND	ND	ND	ND	ND	570.0	575.5
TSM	8/13/1999	Arroyo Chub	73	W	ND	ND	ND	ND	ND	1.4	ND	ND	77.7	79.1
TSM	8/9/2000	Arroyo Chub	90	W	ND	ND	ND	ND	ND	ND	ND	ND	24.9	24.9
VCAILG	4/8/2008	Arroyo Chub	155	W	ND	ND	ND	ND	ND	48	ND	ND	381.0	429.0

Note:

(1) ND = Not Detected; W = whole body; F = Filet

(2) ChemA includes aldrin, dieldrin, endrin, heptachlor, heptachlor epoxide, chlordane (total), HCH (total), endosulfan (total), and toxaphene

(3) Number = Number of individual organisms per sample

(4) Organic chemical data in ppb, wet weight

In summary, only one of the 60 water samples was above the CTR human health criteria. None of the sediment samples exceeded ERM/PEL guidelines for Chem A chemicals. There is no indication that CTR criteria for water and SQG for sediments are exceeded such that a listing is required for any of the Chem A pollutants in either water or sediments in the Santa Clara River Estuary. However, analytical detection limits were often greater than CTR criteria and SQG, so that no detection does not necessarily mean the water quality standards and SQG are met. Toxaphene was detected in all of the five fish tissue samples collected from 1994 to 2008. All of the five samples exceeded the FCG for toxaphene, one sample exceeded the FCG for chlordane, and one sample exceeded the FCG for dieldrin. According to the 303(d) listing policy, a single exceedance does not constitute impairment. Therefore, no TMDLs are required for chlordane, dieldrin, or any other Chem A chemical except toxaphene. Toxaphene levels decreased in the samples collected in 1999 and 2000, but most recently, fish tissue data show that toxaphene levels increased again and are even higher than in the 1994 and 1995 samples. Therefore, the TMDL is written for toxaphene and contains monitoring to ensure no future fish tissue impairments due to chlordane and dieldrin.

3 NUMERIC TARGETS

Numeric targets are developed to address the toxaphene listings. Multiple numeric targets are developed to protect beneficial uses. Water column and fish tissue targets for toxaphene are selected as numeric targets. Sediment guidelines for toxaphene are currently not available; therefore, there is no sediment target for toxaphene in this TMDL. If sediment guidelines for toxaphene are available in the future, the Regional Board may reconsider this TMDL to develop the sediment target for toxaphene.

The water and fish tissue targets will protect benthic and aquatic organisms, wildlife, and human health from potentially harmful effects associated with toxaphene. Numeric targets are presented in Table 3-1 and explained in detail further below.

Table 3-1. Numeric targets for water and fish tissue for toxaphene.

Constituent	Water Quality Target[1] (ug/L)	Fish Tissue Target[2] (ug/kg)
Toxaphene	0.0002[2]	6.1

Note:
[1] CTR aquatic life chronic criterion for saltwater.
[2] OEHHA FCG is applied as numeric target for toxaphene.

3.1 WATER COLUMN TARGETS

The CTR aquatic life criterion in saltwater is the numeric target for toxaphene. The saltwater criterion applies to the SCR Estuary because it is tidally influenced fresh water that supports estuarine beneficial uses. The CTR requires that in brackish waters, the more stringent of the saltwater or freshwater criterion applies. The CTR aquatic life saltwater criterion is more stringent than the criterion for protection of human health (organisms only) and will protect human consumption uses as well as aquatic life uses.

3.2 FISH TISSUE TARGETS

The fish tissue target for toxaphene is selected from “Fish Contaminant Goals and Advisory Tissue Levels for Common Contaminants in California Sport Fish: Chlordane, DDTs, Dieldrin, Methylmercury, PCBs, Selenium, and Toxaphene”, which were developed by OEHHA to assist other agencies to develop fish tissue-based criteria with a goal toward pollution mitigation or elimination and to protect humans from consumption of contaminated fish or other aquatic organisms (OEHHA 2008). Use of fish tissue targets is appropriate to account for uncertainty in the relationship between pollutant loadings and beneficial use effects (EPA, Newport Bay TMDL, 2002) and directly addresses potential human health impacts from consumption of contaminated fish or other aquatic organisms. Use of fish tissue targets also allows the TMDL analysis to more completely use site-specific data where limited water column data are available, consistent with the provisions of 40 CFR 130.7(c)(1)(i). Thus, use of FCGs provides an effective method for accurately quantifying achievement of the water quality objectives/standards.

3.3 SEDIMENT TARGETS

The Basin Plan provides narrative objectives that can be applied to sediments but does not provide numeric WQOs for sediment quality. To develop TMDLs, it is necessary to translate the narrative objectives into numeric targets that identify the measurable endpoint or goal of the TMDL and represent attainment of applicable numeric and narrative WQOs. Sediment quality guidelines compiled by NOAA are used in evaluating waterbodies within the Los Angeles Region for development of the 303(d) list.

On February 19, 2008, the State Board adopted a Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality to integrate chemical and biological measures to determine if the sediment-dependent biota are protected or degraded as a result of exposure to toxic pollutants in sediment and to protect human health. The State Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 provides objectives based on multiple lines of evidence that can be applied to sediments but it does not provide individual numeric targets for sediment quality. To develop a TMDL, it is necessary to translate the narrative objectives in the Basin Plan and the multiple lines of evidence in the SQOs into numeric targets that identify the measurable endpoint or goal of the TMDL and represent attainment of applicable numeric and narrative WQOs.

Sediment quality guidelines for toxaphene are currently not available based on the analysis above. Therefore, no sediment numeric target for toxaphene is currently developed for this TMDL.

4 SOURCE ASSESSMENT

This section identifies the potential sources of toxaphene to the SCR Estuary. The results of four fish tissue samples listed in Table 2-6 were used to estimate the likely toxaphene concentrations in water and sediments that would cause these concentrations in tissue. The concentrations of toxaphene in water were obtained by dividing the tissue concentrations by the bioconcentration factor (BCF) for toxaphene. The concentrations of toxaphene in sediments were obtained by multiplying the concentrations in water by the distribution coefficient (K_d). The K_d was obtained by multiplying the organic-carbon-normalized distribution coefficient (Koc) for toxaphene by the fraction of organic carbon (f_{oc}) in sediments. The f_{oc} was obtained from VWRF's dry weather and wet weather sediment sampling events (Kamman Hydrology & Engineering, Inc., 2005) by averaging the f_{oc} values of 22 samples taken at 11 sites in the Estuary. Results in Table 4-1 show that the estimated concentrations in water are in the range of 0.0019 ppb to 0.0435 ppb. Concentrations within this range can be non-detectable since the detection limits for water samples are generally 0.01 ppb to 10 ppb. The concentrations in sediments calculated from the 1994, 1995, and 2008 tissue samples are 18.2 ppb, 41.4 ppb, and 27.7 ppb, respectively. The reporting limits for toxaphene in sediments are generally 10 ppb to 100 ppb and a reporting limit as high as 340 ppb was reported for some sediment sampling events. These predicted sediment concentrations are hence not always detectable. The concentrations in sediments calculated from the 1999 and 2000 tissue samples are 1.8 ppb and 5.6 ppb, respectively. These concentrations are non-detectable.

This analysis demonstrates that while concentrations in water and sediments can be non-detectable, the concentrations in fish tissue are detectable due to bio-accumulation effects. Therefore, when analyzing data from various sources, those sources with no toxaphene detected could not be ruled-out solely based on analytical results of water and sediment samples. While monitoring data from land use runoff and major NPDES discharges are analyzed to estimate the magnitude of loads of toxaphene to the SCR Estuary, the historic uses of toxaphene is the major factor used to determine potential sources of toxaphene to the SCR Estuary.

Table 4-1. Predicted toxaphene concentrations in water and sediments based on concentrations in fish tissue.

Date of Tissue Sampling	Toxaphene in Tissue ppb	BCF	Estimated Toxaphene in Water ppb	foc	Koc	Kd (L/Kg)	Estimated Toxaphene in Sediment ppb
6/30/1995	570.0	13100	0.043511	0.004555	208929.6	951.7	41.4
6/24/1994	250.0	13100	0.019084	0.004555	208929.6	951.7	18.2
8/13/1999	77.7	13100	0.005931	0.004555	208929.6	951.7	5.6
8/9/2000	24.9	13100	0.001901	0.004555	208929.6	951.7	1.8
4/8/2008	381.0	13100	0.029084	0.004555	208929.6	951.7	27.7

[1]. BCF and Koc are obtained from http://www.syrres.com/esc/chemfate.htm

4.1 POTENTIAL SOURCE AREA

In consideration of the boundary of the TMDL area, fish tissue data from the TSM program for sampling sites upstream of the SCR Estuary were investigated (Table 4-2). There are two sampling sites upstream of the SCR Estuary in Ventura County. One sampling site is located upstream at Santa Paula in Reach 3 of the SCR. The other sampling site is located at Santa Paula Creek, which is tributary to Reach 3 of the SCR. Toxaphene was not detected at either site. The results suggest that the TMDL area should be defined downstream of these sites.

Table 4-2. Summary of fish tissue data upstream of the SCR Estuary from TSM Program.

Site Name	Date of Sampling	Species	Tissue	Toxaphene
Santa Clara River at Santa Paula	5/20/1981	Brown Bullhead	F	ND
Santa Clara River at Santa Paula	5/20/1981	Sucker	F	ND
Santa Clara River at Santa Paula	4/17/1984	Sucker	F	ND
Santa Clara River at Santa Paula	6/29/1992	Arroyo Chub	W	ND
Santa Paula Creek at Stekel Park	6/24/1994	Threespine Stickleback	W	ND

Note:
(1) ND = Not Detected; W = whole body; F = Filet

Staff also considered the location of the Freeman Diversion in defining the TMDL source area. The Freeman Diversion is located at the boundary between Reaches 2 and 3 of the SCR. The Freeman Diversion Facility was constructed to conserve groundwater resources in the Oxnard Plain. Construction was completed in 1991, providing a permanent diversion structure to replace the earthen berms long used in this vicinity to divert surface water from the Santa Clara River. The diversion structure is located upstream of the Highway 118 bridge, approximately 10.7 miles upstream from the Pacific Ocean. The facility is comprised of a concrete dam, related flow control structures, and a fish ladder. Surface water is routed by canal and pipeline to spreading grounds in the Oxnard Forebay, the primary recharge area for the unconfined aquifers of the Oxnard Plain. Diverted surface water is also delivered by pipeline directly to agricultural users in overdrafted areas of the Oxnard Plain.

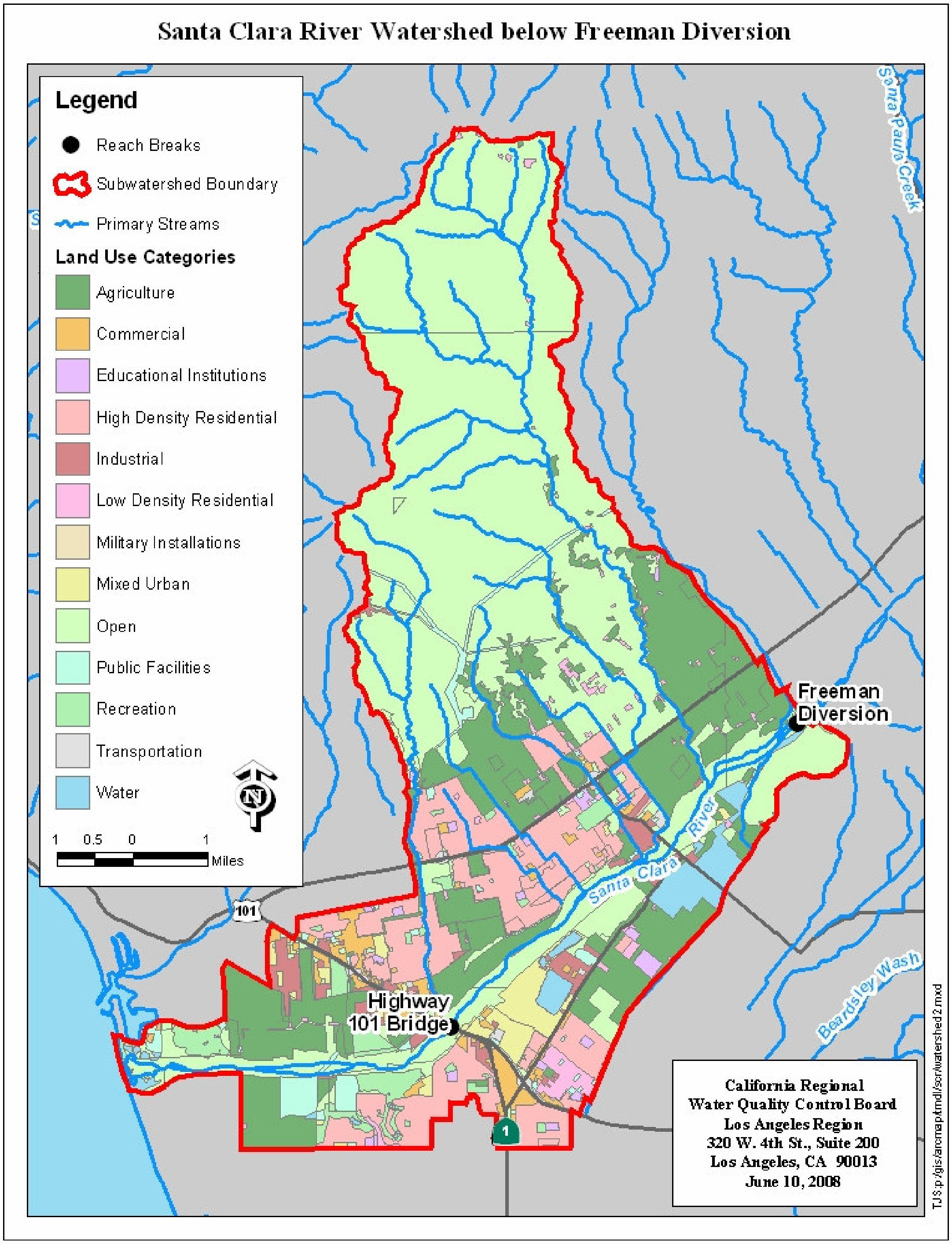
The Freeman Diversion is operated by United Water Conservation District (UWCD) according to criteria established by both the State Water Resources Control Board and the National Marine Fisheries Service (NMFS). The facility may divert a maximum of 375 cfs, and flows in excess of this amount spill over the structure and continue downstream. During the winter and spring months, significant rainfall events may generate enough runoff for the migration of endangered Southern Steelhead trout. During these potential migration periods, downstream flows are managed to meet specific migration criteria established by NMFS. Operational considerations also influence the periods of diversion at the facility.

Diversions are typically suspended when the turbidity of the river exceeds 3000 NTU, as suspended sediment impairs the ability of spreading basins to percolate water. Diversions are also suspended every few days, and flow in the river is used to scour accumulated sediment from near the diversion intake works. Natural groundwater recharge occurs in the Oxnard Forebay basin downstream of the Freeman Diversion in the SCR, and downstream flow generally decreases between the Diversion and the Highway 101 bridge as river water percolates into the river bed. Between the 101 bridge and the estuary a confining clay layer exists in the subsurface, and perennial flow generally exists in this reach.

To evaluate toxaphene loadings upstream of Freeman Diversion, Regional Board staff collected two sediment/soil samples on February 28, 2008. One sample was collected about 100 ft downstream of Freeman Diversion Dam to evaluate sediments that are flushed down from the dam. One sample was collected from a pile of dredged soil that comes from years of flocculation of suspended solids in diverted water. Samples were collected following the sediment collection SOP in the SWAMP Quality Assurance Management Plan. Samples were shipped to the EPA Region IX laboratory where they were analyzed for organochlorine pesticides. The results showed that there was no toxaphene detected.

The Freeman Diversion is considered the upper boundary of the source area (Figure 4-1) since a significant amount of water is diverted at the Diversion and flow is significantly reduced downstream. No toxaphene was detected in fish tissue samples sampled in Reach 3 of the SCR, immediately upstream of the Freeman Diversion. Sediment/soil samples sampled at the Freeman Diversion showed no detection of toxaphene. It is not expected that pesticides from sources upstream of the Freeman Diversion have significant contribution to pesticides in the SCR Estuary.

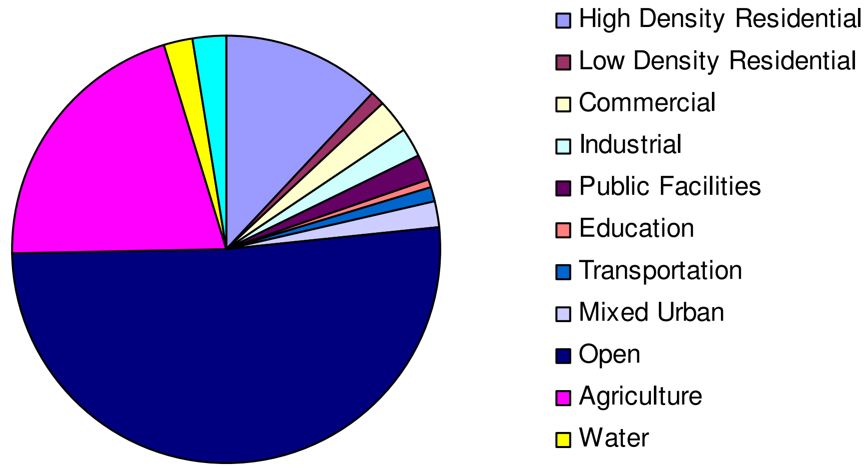
Figure 4-1. Waterbodies addressed in this TMDL.



4.2 LAND USE

Land uses in the TMDL area are 51% open space, 21% agriculture, and 12% high density residential (Figure 4-2). Other land uses range from 0.7% to 2.4%, including recreation, commercial, industrial, water, public facilities, mixed urban, low density residential, transportation, and education. Agriculture is the largest land use associated with pesticide applications.

Figure 4-2. Land uses in the Santa Clara River TMDL area.



4.3 HISTORICAL USE OF TOXAPHENE

4.3.1 Chemical Properties of Toxaphene

Chemical properties of toxaphene are shown in Table 4-3. The Henry's Law constant (K_h) is the ratio of the aqueous-phase concentration of a chemical to its equilibrium partial pressure in the gas phase. K_h measures the likelihood of volatilization of chemicals. The octanol/water coefficient K_{ow} is defined as the ratio of a chemical's concentration in the octanol phase to its concentration in the aqueous phase of a two-phase octanol/water system. K_{ow} measures the solubility of a chemical in lipids. If the K_{ow} is between 3 and 6, a chemical is predicted to bioaccumulate (Newman and Unger, 2002). The K_{oc} describes the distribution or partitioning of a chemical between water and organic carbon on sediments. The half life measures persistence of a chemical, which may undergo hydrolysis, photolysis, and/or biodegradation in the environment and be broken down with time. The water solubility measures the affinity of a chemical with the water phase. A chemical with high water solubility is more likely to move with surface water, and less likely to bioaccumulate.

Table 4-3. Chemical properties of toxaphene.

Constituent	Molecular Weight [1]	Henry's Law Constant [2] (atm-m^3/mole)	Log K_{OW} [2]	Log K_{OC} [2]	Log BCF [2]	Half Life in Soil, Low (days) [1]	Half Life in Soil, High (days) [1]	Water Solubility (mg/L) [2]
Toxaphene	414	6.00E-06	4.68	5.32	3.49	9	5,110	0.74

K_{ow} = octanol-water partitioning coefficient, K_{oc} = organic carbon-normalized distribution coefficient,

BCF = bioconcentration factor,

[1] Sources: ATSDR website
(www.atsdr.cdc.gov/toxfaq.html), EXTOXNET website
(http://pmep.cce.cornell.edu/profiles/extoxnet/),

Journal of Pesticide Reform website (www.pesticide.org) , Mackay et al. (1997)

[2] Source: Syracuse Research Corporation,
http://www.syrres.com/esc/chemfate.htm

4.3.2 Use History of Toxaphene

Toxaphene has been banned from use and manufacture in the United States. Toxaphene was first used as an insecticide in the 1940s. After DDT was banned in 1969, toxaphene became the most heavily used insecticide in the United States. In 1982, the registrations of toxaphene for most uses as a pesticide or pesticide ingredient were cancelled by EPA. In 1990, all registered uses of toxaphene were banned and existing stocks were not allowed to be sold or used in the United States.

Toxaphene is a mixture of over 670 chemicals. Toxaphene has been used to control insect pests on crops, control insect pests on livestock, and kill unwanted fish in lakes (ATSDR, 1997). The environmental fate of toxaphene as a mixture rather than individual components has been investigated previously by most investigators. Estimates of toxaphene concentrations are semiquantitative since the congener composition in the environment changes with the processes of fate and transport.

Pesticide use reporting has been enforced since at least 1950, when the California Department of Food and Agriculture required agricultural pest control operators to submit monthly reports through the county agricultural commissioners. In 1970, the regulations were changed to require commercial pest control operators (those engaged in pest control for hire, such as ground and aerial applicators, structural applicators, and professional gardeners) to report all pesticides used and to require that farmers report only their use of restricted materials of their work (DPR, 2000).

Pesticide use data are available from the California Department of Pesticide Regulation (DPR) at the county scale since 1974. Since only a part of township information is available for pesticides applied, no detailed information is available about uses of toxaphene in the SCR Estuary TMDL area. Toxaphene use data in Ventura County are summarized in Tables 4-3 and 4-4 and Figure 4-3. Toxaphene use was significantly reduced since the registrations for most uses were cancelled by EPA in 1982.

Table 4-3. Reported toxaphene applications by commodity type in Ventura County since 1974.

Commodity	Number of Uses		Pounds Applied	
Bean	1595	40.0%	254171	62.1%
Celery	1366	34.2%	83492	20.4%
Tomato	421	10.6%	36530	8.9%
Ornamental	217	5.4%	9346	2.3%
Turf	29	0.7%	8646	2.1%
Pepper	107	2.7%	6921	1.7%
Strawberry	29	0.7%	3063	0.7%
Broccoli	33	0.8%	2313	0.6%
Lettuce, head	38	1.0%	1730	0.4%
Cabbage	68	1.7%	1199	0.3%
Flower	28	0.7%	524	0.1%
Cauliflower	17	0.4%	396	0.1%
pepper, chili	5	0.1%	444	0.1%
Lettuce, leaf	3	0.08%	328	0.08%
Structural control	3	0.08%	176	0.04%
Federal agency	3	0.08%	136	0.03%
Spinach	1	0.03%	50	0.01%
Corn	1	0.03%	24	0.006%
School district	11	0.3%	17	0.004%
Brussels sprouts	1	0.03%	14	0.003%
Shrub	3	0.08%	11.3	0.003%
County agricultural commissioner	1	0.03%	2.5	0.001%
Univ. of California	8	0.2%	0.3	0.0001%
Carrot	1	0.03%	0.2	0.00005%
Sugarbeet	1	0.03%	0.2	0.00005%
Total =	3990	100%	409534	100%

[1]. Data from DPR.

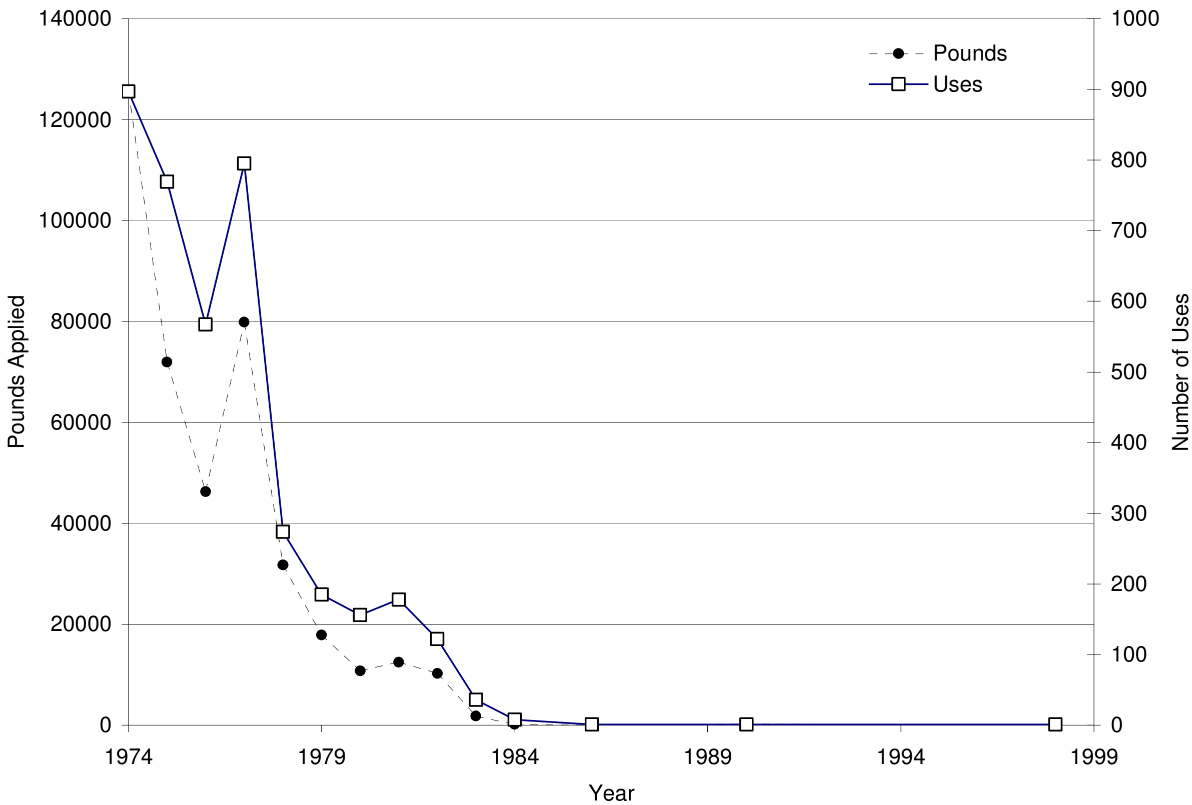
[2]. Data may contain errors in some of the factors used to convert liquid formulations to pounds of active ingredient.

Table 4-4. Reported toxaphene applications by use type in Ventura County since 1974.

Use Type	Pounds Applied		No. of Uses	
Agricultural	409705	99.995%	3969	99.5%
Home/Garden	20	0.0049%	19	0.48%
Household	0.3	0.0001%	1	0.03%

Note: The one time use of 0.45 pound for structual pest control in 1998 is not included since use code was not provided in the 1998 report.

Figure 4-3. Reported toxaphene applications by year in Ventura County since 1974.



[1]. Data from DPR.

[2]. Data may contain errors in some of the factors used to convert liquid formulations to pounds of active ingredient.

As shown in Tables 4-3 and 4-4, agricultural uses of toxaphene account for 99.995% based on pounds applied and 99.5% based on number of uses, mostly for bean, celery and tomato. Other non-agricultural uses such as uses by school districts, county agricultural commissioner, and University of California are trivial in percentage for both number of uses and pounds applied, and most uses are confirmed by township information to have not occurred in the SCR Estuary TMDL area. Based on historical uses of toxaphene in Ventura County, it is reasonable to conclude that discharges from agricultural lands are the sole source of toxaphene in the SCR Estuary TMDL area.

4.4 MONITORING DATA FROM DIFFERENT SOURCES

Pollutants can enter surface waters from both point and nonpoint sources. Point sources typically include discharges from discrete human-engineered conveyances. These types of discharges are regulated through the federal NPDES program, which the Regional Boards have been delegated to implement through the issuance of WDRs. Nonpoint sources, by definition, include pollutants that reach surface waters from a number of diffuse land uses and activities that are not regulated through NPDES permits. In Ventura County, urban runoff to the Santa Clara River and Estuary is regulated under storm water NPDES permits as a point source discharge. Non-point sources typically include discharges from agricultural lands and atmospheric deposition.

4.4.1 Non-Point Sources

4.4.1.1 Discharges from Agricultural Lands

The major non-point sources in the SCR Estuary area are discharges from agricultural lands. Discharges from agricultural lands may contain pesticides that were applied to crops, which can impair waterbodies when discharged. There were no requirements for monitoring discharges from agricultural lands before 2005. On November 3, 2005, the Los Angeles Regional Board adopted a Conditional Waiver (Order No. R4-2005-0080) for these discharges. Irrigated lands dischargers must be covered by the Conditional Waiver or, alternatively, submit a report of waste discharge and apply for a discharge permit. There are currently two established discharger groups participating in the Conditional Waiver for Irrigated Lands. One of the groups, VCAILG, represents growers in Ventura County.

VCAILG has submitted its 2007, 2008, and 2009 annual monitoring reports for nine sampling events to the Regional Board. Sites S02T_ELLS and S02T_TODD drain to Reach 2 and are located in the TMDL area. Available monitoring data are summarized in Table 4-5 as shown below. There are two exceedances of toxaphene out of 8 samples. Both samples exceeded the CTR water quality criterion for toxaphene for protection of aquatic life (chronic).

Table 4-5. Summary of toxaphene in irrigated lands discharge from VCAILG monitoring sites within the TMDL area.

Site Name	Date	Toxaphene (µg/L)
S02T_TODD	2/6/2009	0.25
S02T_TODD	8/4/2009	0.1734 [1]
S02T_ELLS	2/6/2009	ND[2]
S02T_ELLS	1/5/2008	ND
S02T_ELLS	1/24/2008	ND
S02T_ELLS	5/20/2008	ND
S02T_ELLS	9/16/2008	ND
S02T_ELLS	12/19/2007	ND

[1] Listed value is estimated.

[2] ND = Not detected.

The VCAILG monitoring site OXD_CENTR is located in the McGrath Lake subwatershed, just south of the SCR Estuary. Drainage from the McGrath lake subwatershed flows to the SCR Estuary when flows are less than the 10-year storm. OXD_CENTR is located on the Central Ditch, which flows under Harbor Blvd and into McGrath Lake. While this site does not measure the direct discharge to the SCR Estuary, samples collected from this site are representative of the quality of water discharged from the subwatershed. For a total of 9 sampling events during the 2007-2009 sampling periods, there were two total chlordane and two toxaphene exceedances.

In addition to the VCAILG data, information about pesticides loading from agricultural runoff was obtained from water quality data collected by Coastal Berry Company in compliance with Cleanup and Abatement Order No. R4-2003-0065. Coastal Berry is one of several agricultural fields located south of the SCR Estuary. The McGrath Ditch, North Ditch, West Ditch, and Coultas Ditch drain runoff and tail water from these agricultural fields directly to the SCR Estuary and to the Central Ditch, which then drains to the McGrath Lake. The McGrath ditch also receives runoff from a closed landfill. Pumps have also been used to drain runoff and tail water to the SCR Estuary from these ditches. In 2003, the Coastal Berry Company took 5 water samples during dry weather and wet weather from: (1) the Central Ditch, (2) the place where water is pumped to the Estuary in the West Ditch (wet weather only), and (3) the Estuary. No toxaphene was detected in any of the samples.

4.4.1.2 Atmospheric Deposition

Since toxaphene has been banned for use, the only potential atmospheric deposition sources of toxaphene are suspended soils in air. These soils may be deposited either indirectly to the land surface and washed into the Estuary or deposited directly to the Estuary. The indirect deposition is assumed as part of the agricultural land use load. The potential direct deposition is small, since the portion of the TMDL area covered by water is small, approximately 0.2 acres or 3.6% of the TMDL area.

4.4.1.3 In Situ Sediments

Historical aerial photographs show that the riverbed in the Estuary is dynamic. Substantial change in morphology of the riverbed and vegetation cover has been observed. Stream flow records suggest that the riverbed is mobilized at least once every 2-3 years on average (Swanson, Josselyn, and McIver, 1990). Sediment transport, scour, and erosion occur during flooding events and cause migration of river channels. Therefore, historic sediment deposition occurs at different locations in different years. It is likely that patches of sediments deposited at different years lie in the river bed at various locations. The available sediment sampling data in Table 2-5 show no exceedance of toxaphene. However, these samples may represent only some of the sediment patches. It is possible that sediment patches with high toxaphene levels were not sampled in previous sampling events due to spatial variation or sandy soils.

4.4.2 Point Sources

A point source, according to 40 CFR 122.3, is defined as “any discernable, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel, or other floating craft from which pollutants are or may be discharged.” The NPDES Program, under CWA sections 318, 402, and 405, requires permits for the discharge of pollutants from point sources.

The NPDES permits in the SCR Estuary area include the municipal separate storm sewer system (MS4) Permits, general construction storm water permits, general industrial storm water permits, individual NPDES permits, and general NPDES permits.

4.4.2.1 Storm Water Permits

Storm water runoff in the SCR Estuary area is regulated through a number of permits. The first is the MS4 permit issued for discharges of urban runoff and stormwater in Ventura County and the incorporated cities within Ventura County. The second is a separate statewide storm water permit specifically for the California Department of Transportation (Caltrans). The third is the statewide Construction Activities Storm Water General Permit and the fourth is the statewide Industrial Activities Storm Water General Permit. The permitting process defines these discharges as point sources because the storm water discharges from the end of a storm water conveyance system. Since the industrial and construction storm water discharges are enrolled under NPDES permits, these discharges are treated as point sources in this TMDL.

<u>MS4 Storm Water Permits</u>

In compliance with the MS4 permit, the Ventura County Watershed Protection District (VCWPD) conducts the Stormwater Monitoring Program in Ventura County. The monitoring program in the SCR watershed includes one mass emission station at the Freeman Diversion (ME-SCR) and two downstream land use sites (I-2 at Ortega St., and R-1 at Swan St. and Macaw Ave.). Monitoring data from the mass emission station are from November 2002 to December 2009. Data from the land use sites are from January 1993 to October 2004. Data are summarized in Table 4-6 as shown below.

Table 4-6. Summary statistics for toxaphene for Land Use Stations I-2 and R-1 and Mass Emission Station ME-SCR.

Constituent	No. of Samples	No. Detect	Target (µg/L)	No. Exceeded
I-2	20	0	0.0002 [1]	0
R-1	21	0	0.0002 [1]	0
ME-SCR	42	1	0.0002 [1]	1

[1]: CTR water quality criteria for protection of aquatic life. Chronic criteria are applied.

[2] Data obtained from: http://www.vcstormwater.org/programs_monitor.html .

For the land use stations, a total of 20 and 21 samples were collected from Stations I-2 and R-1, respectively. There are no detections of toxaphene at either I-2 or R-1. A total of 42 samples were collected from the Mass Emission Station ME-SCR and there is one detection of toxaphene that exceeded the target. The detection limits for the VCWPD samples range from 2 µg/L to 0.001 µg/L.

Caltrans Storm Water Permit

As stated previously, Caltrans is regulated by a statewide storm water discharge permit (State Board Order No. 99-06-DWQ). The Caltrans storm water permit authorizes storm water discharges from Caltrans properties such as the state highway system, park and ride facilities, and maintenance yards.

It is assumed that the storm water discharges from most of these Caltrans properties and facilities eventually end up in either a city or county storm drain. Therefore, the Stormwater Monitoring Program conducted by VCWPD should capture the pesticides loading from Caltrans properties. The results from the VCWPD monitoring can be considered representative of loading from Caltrans. Furthermore, Caltrans facilities are not likely sources of toxaphene, because they are transportation related facilities which have no uses of toxaphene.

General Storm Water Permits

On April 17, 1997, State Board issued a statewide general NPDES permit for Discharges of Storm Water Associated with Industrial Activities Excluding Construction Activities Permit (Order No. 97-03-DWQ). This Order regulates storm water discharges and authorized non-storm water discharges from ten specific categories of industrial facilities, including but not limited to manufacturing facilities, oil and gas mining facilities, landfills, and transportation facilities.

Potential pollutants from an industrial site will depend on the type of facility and operations that take place at that facility. Under Order No. 97-03-DWQ, discharges of non-storm water are authorized only where they do not cause or contribute to a violation of any water quality standard and are controlled through implementation of appropriate best management practices (BMPs) for elimination or reduction of pollutants. As of the writing of this TMDL, there are thirty two industrial facilities enrolled under the general industrial storm water permit within the TMDL area. Based on the addresses of these facilities, they all likely discharge to storm drains, instead of discharging directly to the SCR. Therefore, the Stormwater Monitoring Program conducted by VCWPD should capture the pesticides loading from these facilities. The results from the VCWPD monitoring can be considered representative of loading from storm water discharge from industrial facilities. Furthermore, pesticide use data shows no historical use of toxaphene on industrial sites; thus, these sites are not considered a source.

On August 19, 1999, State Board issued a statewide general NPDES permit for Discharges of Storm Water Runoff Associated with Construction Activities (Order No. 99-08-DQW). Under Order No. 99-08-DWQ, discharges of non-storm water are authorized only where they do not cause or contribute to a violation of any water quality standard and are controlled through implementation of appropriate BMPs for elimination or reduction of pollutants. As of the writing of this TMDL, there are twenty six facilities enrolled under the general construction storm water permit within the TMDL area. Based on the addresses of these facilities, all but two of these facilities discharge to storm drains, instead of discharging directly to the SCR. Therefore, the Stormwater Monitoring Program conducted by VCWPD should capture the pesticides loading from those facilities discharging to storm drains. The results from the VCWPD monitoring can be considered representative of loading from storm water discharge from construction facilities; thus these sites are not considered a source.

4.4.2.2 Other NPDES Permits

There are two types of NPDES permits: individual and general permits. An individual NPDES permit is classified as either a major or a minor permit. Other than the MS4 and Caltrans storm water permits there is one major individual NPDES permit in the SCR Estuary area. The discharge flows associated with minor individual NPDES permits and general NPDES permits are typically less than 1 MGD. General NPDES permits often regulate episodic discharges (e.g. dewatering operations) rather than continuous flows.

<u>Individual NPDES Permits</u>

The one major NPDES permit is issued to VWRP (Order No. 2008-0011). VWRP discharges treated wastewater directly to the SCR Estuary. Table 4-7 summarizes monitoring results of VWRP effluent from June 1989 to November 2007. There are no detections of toxaphene in all of the 62 effluent samples.

Table 4-7. Summary statistics for toxaphene in VWRP effluent samples.

Constituent	No. of Samples	No. Detect	Target (µg/L)	No. Exceeded
Toxaphene	62	0	0.0002 [1]	0

[1]: CTR water quality criteria for protection of aquatic life. Chronic Criteria are applied.

<u>General NPDES Permits</u>

Pursuant to 40 CFR parts 122 and 123, the State Board and the Regional Boards have the authority to issue general NPDES permits to regulate a category of point sources if the sources: involve the same or substantially similar types of operations; discharge the same type of waste; require the same type of effluent limitations; and require similar monitoring. The Regional Board has issued general NPDES permits for six categories of discharges: construction and project dewatering; petroleum fuel cleanup sites; volatile organic compounds (VOCs) cleanup sites; potable water; non-process wastewater; and hydrostatic test water.

The general NPDES permit for Discharges of Groundwater from Construction and Project Dewatering to Surface Waters (Order No. R4-2003-0111) covers wastewater discharges, including but not limited to, treated or untreated groundwater generated from permanent or temporary dewatering operations. As of the writing of this TMDL, there are four facilities enrolled in 2003-0111. The effluent limits for pesticides are based on CTR. The fact sheets for these permits indicated that there is no reasonable potential for toxics to exist in discharges of groundwater above the Screening Levels for Potential Pollutants of Concern. Therefore, these discharges are not considered a source of pesticides loadings.

4.5 SUMMARY

Data analysis combined with historic use of toxaphene showed that the contribution of toxaphene to the SCR Estuary from point sources is insignificant. Toxaphene was not detected in monitoring data dated from 1989 to 2007 for VWRP. Toxaphene was not detected at VCWPD land use sites from 1993 to 2004. Toxaphene was detected in one out of 42 samples at the VCWPD mass emission site. Records showed that most historic uses of toxaphene in Ventura County were for agricultural purposes. Although little historic monitoring data for discharges from agricultural lands are available, recent data show a high frequency of toxaphene exceedances, and the major contributor of toxaphene loading to SCR Estuary is assumed to be discharges from agricultural lands. Since contributions from other sources are not significant, it is reasonable to simplify and consider discharges from agricultural lands as the single source of toxaphene loading to the SCR Estuary.

5 LINKAGE ANALYSIS, TMDL AND POLLUTANT ALLOCATION

This section discusses the linkage analysis used for the SCR Estuary and identifies the resulting pollutant allocations. The linkage analysis is used to identify the assimilative capacity of the receiving water for toxaphene by linking the source loading information to the water quality target. It is expected that reductions in loadings of toxaphene from agricultural dischargers in the TMDL area will lead to reductions in fish tissue concentrations in the Estuary over time.

5.1 CONCEPTUAL MODEL FOR FATE AND TRANSPORT OF TOXAPHENE

A conceptual model for fate and transport of toxaphene is established to demonstrate the linkage analysis. Toxaphene is transported to the SCR Estuary by discharges from agricultural lands. Toxaphene from agricultural discharges can either be transported as dissolved in water or sorbed onto suspended solids. Toxaphene distribution in water and in suspended solids depends on the conditional equilibrium between the water phase and the solid phase (suspended solids). Bed sediments in the Estuary may contain toxaphene either due to deposition of suspended solids or reaching adsorption equilibrium between the solid phase (sediments) and the water phase. With the ban of the use of toxaphene in 1990, residue from the drainage area may continue to be flushed into the Estuary, but this flushing may decrease with time.

The existing toxaphene contaminants in bed sediments will be removed over time as sediments are scoured during storms, and as residue toxaphene is desorbed into the water phase. Sediments with residue toxaphene may also be buried under layers of clean sediment with time, or re-surfaced as the clean sediment cover is washed away. Toxaphene can be lost to the atmosphere through volatilization. Toxaphene in sediments and water also undergoes degradation with a half life of 9 to 5110 days (Table 4-3).

Toxaphene that is not removed, volatilized, or degraded may be up taken by plants and accumulate in plant tissues. In addition, through bioturbation and feeding processes, toxaphene may be taken up by benthic organisms. Fish may acquire toxaphene by passing of water through gills, by feeding on plant tissues or smaller organisms, or by contacting contaminated sediments.

5.2 LOADING CAPACITY AND ALLOCATIONS

Based on the source analysis, most toxaphene generated in the TMDL area is transported to the SCR Estuary through discharges from agricultural lands. Based on the conceptual model, the loading capacity is set equal to concentration based numeric targets for water. Concentration-based load allocations are developed for discharges from agricultural lands and implemented through the Conditional Waiver. There are no significant point sources of toxaphene in the TMDL area and thus no waste load allocations.

5.2.1 Load Allocations

Since it is difficult to estimate flow from various agricultural drainages, concentration-based load allocations are developed for agricultural dischargers in the TMDL area to ensure that these dischargers do not cause or contribute to exceedances of water column and fish tissue numeric targets. The concentration-based load allocations for water are equal to the numeric targets. All agricultural discharges in the TMDL area shall not discharge at concentrations greater than the numeric targets for water listed in Table 3-1. In addition, the fish tissue targets will be included directly as benchmarks in the Conditional Waiver.

As stated in source assessment section, based on the frequent mobilization of sediments in the river bed due to scour and deposition of new sediments, it is not necessary to assign a load allocation to in situ sediments. If sediment monitoring finds "hot spots" with detectable toxaphene in the Estuary, then a load allocation to in situ sediments may be considered for this TMDL.

5.2.2 Critical Conditions

There is a high degree of inter- and intra-annual variability in water flow and sediment deposition in the SCR Estuary. This is a function of storms, which are highly variable between years. The concentration-based TMDL represents all flows at all times, and is based on levels of the pollutants found in fish tissue monitoring. Bioaccumulation of toxaphene occurs over long time periods in fish tissue. Since the load allocations apply at all times, the TMDL provides for year-round protection of the water quality standard for toxaphene, including periods when critical conditions occur.

5.2.3 Margin of Safety

TMDLs must include a margin of safety to account for any uncertainty concerning the relationships between sources and sediment quality. An implicit margin of safety is applied through the use of more protective numeric targets and by setting load allocations equal to water column numeric targets. In addition, the fish tissue targets will be included directly as benchmarks in the Conditional Waiver.

6 IMPLEMENTATION

As discussed in the source analysis section, discharges from agricultural lands are the sole source of toxaphene in fish tissue in the SCR Estuary. Toxaphene has been banned from use and manufacture in the United States. The Estuary is flushed over time and sediment transport, scour, and erosion occur during flooding events. Sediments in the Estuary may be flushed away or covered and toxaphene will degrade with time. It is estimated that the riverbed is mobilized at least once every 2-3 years on average (Swanson, Josselyn, and McIver, 1990). Because toxaphene is predominately bound to sediment, which is transported with storm and irrigation runoff from the watershed to the Estuary, it is anticipated that toxaphene concentrations in fish tissue will decrease with time if runoff of irrigated lands in the TMDL area is reduced. The agricultural dischargers to the SCR downstream of the Freeman Diversion in the SCR watershed are responsible for meeting the concentration-based load allocations. It is anticipated erosion control from irrigated lands in the TMDL area, as implemented through the Conditional Waiver, will achieve load allocations for toxaphene and eliminate the impairment in fish tissue in the Estuary. Water and fish tissue monitoring will be included in the Conditional Waiver to evaluate the effectiveness of TMDL implementation.

A single regulatory action through the Conditional Waiver will be used to implement this TMDL. When an implementation plan can be adopted in a single regulatory action, such as a permit, a waiver, or an enforcement order, there is no legal requirement to adopt the TMDL through a basin plan amendment. The TMDL may be adopted directly in that single regulatory action (State Board, 2005). In the case of the Conditional Waiver, an existing regulatory program is already in place. The waiver is being renewed by the Regional Board in October 2010 and the renewed order contains monitoring and enforceable requirements to ensure that load allocations and targets are attained.

6.1 PRESENT STATUS OF THE CONDITIONAL WAIVER PROGRAM

The Conditional Waiver was adopted by the Regional Board on November 3, 2005 (Order No. R4-2005-0080). The objectives of the program are to monitor the water quality effects of discharges from irrigated agriculture lands on receiving waters, and, if required, mitigate those impacts from runoff from irrigated agriculture lands in the coastal watersheds of Los Angeles and Ventura Counties. Irrigated lands dischargers must enroll in the Conditional Waiver or, alternatively, submit a report of waste discharge and apply for a discharge permit. In accordance with the Porter-Cologne Water Quality Act, the Conditional Waiver is in effect for a period of five years and must be renewed every five years.

The monitoring conducted under R4-2005-0080 is implemented in two phases. The first phase covers the monitoring conducted during the 2-year period from the issuance of the Notice of Applicability (NOA). During the first phase, the frequency of monitoring is twice during each dry weather period and twice during each wet weather period. The second phase covers the period from the end of the first phase until the expiration of the Conditional Waiver. During the second phase, the frequency of the monitoring is once during each dry weather period and once during each wet weather period. Toxicity is monitored at least once during each dry weather period.

In the case that the monitoring results show an exceedance of water quality benchmarks (which are equal to WQOs, criteria, and load allocations), dischargers must prepare a Water Quality Management Plan (WQMP). The WQMP identifies the source of the exceedance and determines the impact of the impairment through follow up monitoring, if necessary. Once the source is identified, best management practices must be installed and maintained to reduce or eliminate the impairment to water quality.

The general constituents to be monitored include pollutants associated with agriculture operations, such as nutrients, pesticides, and sediment. Toxicity testing is also required as part of the monitoring program. The water quality monitoring covers toxaphene. However, there is no requirement for monitoring fish tissue and there are no sites that monitor the direct discharges to the Estuary.

There are two options for dischargers to enroll under the Conditional Waiver: (1) as a member of a Discharger Group or (2) as an Individual Discharger. In Ventura County all but one of the agricultural dischargers chose to join VCAILG, which represents growers in Ventura County. Of the 93,000 acres of irrigated lands in Ventura County, approximately 88,000 acres are currently enrolled in VCAILG.

To date VCAILG has submitted three annual monitoring reports for a total of nine sampling events in the TMDL area to the Regional Board. The monitoring results were compared to receiving water benchmarks listed in the waiver. The first WQMP has been prepared by VCAILG and approved by the Regional Board. The second WQMP has been submitted and contains minor revisions to the first WQMP based on additional monitoring data. The WQMP prioritizes BMP outreach and implementation in drainage areas with multiple water quality benchmark exceedances and/or TMDLs. The McGrath Lake subwatersed area was identified as a Tier 1 priority area. BMP implementation was initiated spring 2009 and is continuing through 2010.

6.2 IMPLEMENTATION PLAN AND REVISIONS TO THE CONDITIONAL WAIVER

The regulatory mechanism used to implement the TMDL will be the Conditional Waiver, which is an existing program approved by the Regional Board in 2005 and which will be reconsidered in 2010. Currently there are no requirements for fish tissue monitoring in the Conditional Waiver and no water quality monitoring sites located in the TMDL area. When the Conditional Waiver is reconsidered in 2010, fish tissue monitoring in the SCR Estuary and water column monitoring in agricultural drains in the surrounding TMDL area will be incorporated into monitoring requirements of the Conditional Waiver. In addition, the load allocation for toxaphene in water and the numeric target for toxaphene in fish tissue will be included as benchmarks, which will apply upon the effective date of the revised Conditional Waiver. Compliance with benchmarks can be achieved through an escalating, iterative BMP process. For example, if the benchmarks are exceeded at the additional monitoring sites, then the agricultural dischargers must prepare a WQMP that identifies BMPs to eliminate loadings from this source and implement those BMPs. If ongoing monitoring shows continued exceedances of benchmarks, BMPs must be improved or added in a targeted, iterative fashion until benchmarks are achieved.

It is expected that concentrations in fish tissue will attenuate and numeric targets for tissue and the water column will be achieved over time as toxaphene loading from agricultural dischargers in the TMDL area is eliminated through compliance with benchmarks. Within ten years of the effective date of the revised Conditional Waiver, if concentrations in tissue are not attenuating, such that it appears that numeric targets will be achieved within 15 years, the Regional Board will reconsider the TMDL. The revised TMDL may specify additional requirements for agricultural dischargers in the TMDL area, or identify additional responsible parties within the TMDL area or above the Freeman Diversion and assign allocations and/or other requirements to those parties.

7 MONITORING

Irrigated land dischargers will conduct water column and fish tissue monitoring for toxaphene to ensure attainment of load allocations and numeric targets and water quality standards in the Estuary. In addition, as discussed in section 2.2.3, chlordane and dieldrin shall be monitored to ensure no future impairments.

Water quality monitoring will be conducted at one representative agricultural drain that discharges directly to the Estuary (below Harbor Blvd) and one representative agricultural drain that discharges to the river upstream of the Estuary. Water quality samples shall be analyzed for total suspended solids, toxaphene, chlordane, and dieldrin. The frequency shall be consistent with and at least equivalent to monitoring specified in the Conditional Waiver adopted by Order No. R4-2005-0080. The fish tissue monitoring will be conducted at a frequency of once every three years in the Estuary. Fish tissue samples shall be analyzed for toxaphene, chlordane, and dieldrin.

After the Conditional Waiver is reconsidered in 2010, the Executive Officer will approve revised monitoring and reporting program plans (MRP) that must contain the additional monitoring requirements for this TMDL. Samples shall be collected in accordance with SWAMP protocols, where available or alternative protocols proposed by dischargers and approved by the Executive Officer. It is noted that analytical detection limits for toxaphene, chlordane, and dieldrin in water are greater than the criteria, so the applicability of water monitoring data is limited by analytical techniques. As analytical methods and detection limits continue to improve (i.e. development of lower detection limits) and become more environmentally relevant, responsible parties shall incorporate new method detection limits in the MRP.

The Regional Board initially expects a ten-year sampling program with sampling results reported to the Board annually. Regional Board staff will review the annual reports and in the event that results indicate numeric targets are not being met, staff will require additional actions on the part of the irrigated land dischargers to investigate the cause(s) and achieve the numeric targets. Regional Board staff will review the data annually for the ten-year period, looking for at least three consecutive fish tissue samples that show a decreasing trend in toxaphene concentrations. If there is not a decreasing trend in concentrations, such that it appears numeric targets will be achieved in 15 years, then the Regional Board will reconsider this TMDL to determine whether additional implementation requirements are necessary.

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